

## REMARKS

Claims 1-15 are pending.

Claim 1 has been amended to include a clearer recitation of the fractional crystallization of the present invention in accordance with the description on page 1, lines 10-13 of the specification.

Claim 3 has been amended to correct a typographical error. Applicant thanks the Examiner for the suggestion to correct the typographical error.

Claim 11 has been amended to correct the lack of antecedent basis for “the length of the layer” noted in the 35 U.S.C. §112, second paragraph rejection of claim 11.

No new matter is presented by the above amendments.

### I. 35 U.S.C. §112

Claim 11 has been rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that applicant regards as the invention in reciting the limitation “the length of the layer”. Applicant submits this rejection is now moot and should be withdrawn in view of the current amendment to claim 11 to recite “a length of the layer”.

### II. 35 U.S.C. §102

#### A. Claims 1, 3, 4, and 6 stand rejected under 35 U.S.C. §102(b) as being anticipated by Russian patent document 2 105 084 (RU'084)

With respect to claims 1 and 3, RU'084 is said to disclose a method for forming a protective coating on the surface of metallic articles (e.g. Zr alloys) when the article is cooled with liquid nitrogen (p. 2) while the article is melted in succession (e.g. with a laser beam) and a mixture of liquid nitrogen and inert gas is fed to the melting zone, forming a surface nitride (p. 3). It is then asserted the liquid nitrogen contacts the layer of at most partially solidified molten metal (i.e. working zone (4) above and near the layer of at most partially solidified molten metal. It is then asserted that since only the surface of the work-piece is melted and recrystallized, and this is limited to discrete sections at a time, the method is broadly interpreted to meeting the preamble recitation of “fractional crystallization”. It is also asserted the additional supply of nitrogen and argon at (4) would provide cooling of the cooling liquid in at least one spot near the layer of at most partially solidified molten metal.

Applicant agrees RU'084 discloses a method for forming a protective coating on the surface of metallic articles. However, this method does not disclose fractional crystallization of crystals of a composition different from the composition of the molten metal, e.g., crystals of metallic impurities such as Fe, as now more clearly defined in amended claim 1. The cooling with liquid nitrogen in RU'084 does not anticipate or make obvious, the cooling of at most partially solidified molten metal by a layer of cooling liquid in a method of fractional crystallization according to the claimed invention.

- B. Claims 1, 3 and 7 stand rejected under 35 U.S.C. §102(b) as being anticipated by Bliss et al. (U.S. Pat. No. 6,143,070)

Bliss et al. is cited to disclose a method for growing single crystals of SiGe by combining zone melting in a quartz container with a liquid encapsulation of molten salt to prevent nucleation at the container-melt surface (col. 2 lines 45-49). The process includes melting the Si-Ge charge, placing calcium chloride in solid form on the top of the melt so when it melts it covers the inner surface of the ampoule, and crystal growth by a water cooled concentrator located outside the ampoule. A temperature profile through the center of the melt (Figure 2) allegedly shows the temperature decrease at the edges (i.e. the location of the melted salt). It is then asserted the molten salt is a cooling liquid and the concentrator provides cooling of the molten salt in at least one spot near the layer of at most partially solidified molten metal.

Applicant submits Bliss et al does not teach or suggest a method of fractional crystallization of an at most partially solidified molten metal in accordance with amended claim 1. Moreover, the calcium chloride melted salt is used to create a “non-wetting buffer layer between the quartz container and the SiGe charge material” (column 1, lines 58-60). It is not used as a cooling liquid in the manner claimed. Since Bliss et al. does not teach the fraction crystallization method of the present invention and lacks an essential element, i.e. the cooling liquid present above and/or below the layer of at most partially solidified metal to crystallize the molten metal, the rejection based upon anticipation has been overcome and applicant respectfully requests this rejection be withdrawn.

- C. Claim 1 stands rejected under 35 U.S.C. §102(b) as being anticipated by Masumoto et al. (U.S. Pat. No. 4,781,771)

Matsumoto et al discloses amorphous Co-based metal filaments produced by jetting a molten stream of the alloy into a cooling liquid for solidification. However, it does not disclose

or suggest a fractional crystallization of an at most partially solidified molten metal according to amended claim 1. It is submitted the recitation of the fractional crystallization of the molten metal to produce crystals having a composition different from the composition of the starting molten metal provides a patentable distinction since the fractional crystallization affects the structure of the final product.

- D. Claims 1, 2, 7 and 12 have been rejected under 35 U.S.C. §102(b) as being anticipated by Beguin et al. (U.S. Pat. No. 4,099,965)

Beguin et al. is cited as disclosing a method for purification of an aluminum-magnesium alloy by using a flux composition of magnesium chloride and potassium chloride to remove sodium and calcium metals present in the alloy. It is asserted, although not recited in Beguin et al., the flux would be expected to melt, since its melting temperature is lower than aluminum and it is exposed to molten aluminum. The method taught in Beguin et al removes certain impurities from the alloy through use of a lower temperature melting flux. However, Applicant submits this is not a fractional crystallization method as claimed in the currently amended claim 1. Applicant therefore respectfully requests this rejection be withdrawn.

- E. Claims 1, 4, 6-10, 13 and 15 stand rejected under 35 U.S.C. §102(b) as being anticipated by Bruno et al. (U.S. Pat. No. 3,839,019)

Bruno et al. is cited as disclosing a method for aluminum purification by chloridizing molten aluminum (abstract) with a molten salt formed from the chloridization reaction products of the metallic impurities, including magnesium. Applicant disagrees with the assertion in the Office action that the method of using a reactive chlorinaceous gas in Bruno to contact molten aluminum can be interpreted as a fractional crystallization process. Moreover, it fails to disclose or suggest the fractional crystallization of amended claim 1. Applicant therefore respectfully requests this rejection be withdrawn.

- F. Claims 1, 3, 6, 7 and 11 stand rejected under 35 U.S.C. §102(b) as being anticipated by Benz et al. (U.S. Pat. No. 5,160,532)

Benz et al. is cited for the disclosure of a method for electroslag refining an ingot (24) where the ingot is heated and covered in a molten salt, forming a melt pool beneath the molten salt. Benz describes a purifying process. However, this process is not a fractional crystallization process. It particularly differs from the presently claimed fractional crystallization process in amended claim 1 and the claims dependent thereon.

Applicant respectfully requests the rejection of the claims over Benz et al. be withdrawn.

III. 35 U.S.C. §103

- A. Claims 5 and 14 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Russian patent document 2 105 084 (RU'084)

RU'084 is applied as in section I A above. With respect to claims 5 and 14, the Office action asserts RU'084 does not recite recycling the cooling liquid or recycling and cooling the liquid. However, such would have been obvious to one of ordinary skill in the art at the time the invention was made for the obvious reason of saving the cost of nitrogen and providing the desired temperature of -196° C (p. 4).

Applicant again submits the fractional crystallization process in claim 1 distinguishes over RU'084. The alleged obvious use of recycling of nitrogen in this reference would not remedy this deficiency.

- B. Claims 5 and 14 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Bliss et al. (U.S. Pat. No. 6,143,070) or Beguin et al. (U.S. Pat. No. 4,099,965)

Bliss et al. and Beguin et al. are applied as discussed above regarding claim 1 in Section II B and D above.

With respect to claims 5 and 14, the Office action asserts Bliss et al. and Beguin et al. do not recite recycling the cooling liquid or recycling and cooling the liquid. However, such would have been obvious to one of ordinary skill in the art at the time the invention was made for the obvious reason of saving costs for purchase of the salts as well as coats associated with disposal of such if not recycled. Cooling is said to have been obvious in view of the addition of the salt as a solid.

Applicant again submits the claims distinguish over the Bliss et al. and Beguin et al. references in reciting the fractional crystallization process in claim 1. The alleged obvious use of recycling of the melting salts in the references, and the alleged equivalence of salts to the present cooling liquid, would not make up for the deficiencies of these references.

- C. Claims 5 and 14 have been rejected under 35 U.S.C. Claims 5 and 14 under 35 U.S.C. §103(a) as being unpatentable over Masumoto et al. (U.S. Pat. No. 4,781,771)

Masumoto et al. has been applied as discussed above in Section II C regarding claim 1.

With respect to claims 5 and 14, the Office action asserts Masumoto et al. does not recite recycling the cooling liquid or recycling and cooling the liquid. However, such would have been obvious to one of ordinary skill in the art at the time the invention was made for the obvious reason of saving costs for purchase and disposal of water if not recycled. Cooling is said to have been obvious in view of the disclosure that water is used for cooling purposes.

Applicant again submits the fractional crystallization process in claim 1 distinguishes over Masumoto et al. and the alleged obvious use of recycling of the cooling water would not make up for the deficiency of Masumoto et al. to teach or suggest the claimed fractional crystallization process.

- D. Claims 5 and 14 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Benz et al. (U.S. Pat. No. 5,160,532)

Benz et al. has been applied as discussed above in Section II F regarding claim 1.

With respect to claims 5 and 14, the Office action asserts Benz et al. does not specifically recite recycling the cooling liquid or recycling and cooling the liquid. However, such would have been obvious to one of ordinary skill in the art at the time the invention was made for the obvious reason of saving costs for purchase of the salts as well as costs associated with the disposal of the salt if not recycled. Cooling is said to be provided by the cooling reservoir (32).

Applicant submits the fractional crystallization process in claim 1 distinguishes over Benz et al. The alleged obvious use of recycling of the salts in the reference, which are not the same as the cooling liquid in the claimed process, for cost savings would not make up for the deficiency of Benz et al. to teach or suggest the claimed fractional crystallization process.

IV. Double Patenting.

Claims 1-15 have been provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 2, 5 and 9-12 of copending Application No. 10/516,888 ('888).

When these claims are found otherwise patentable, then -applicant will determine whether to file a terminal disclaimer, or traverse the rejection, since at the present time this is only a provisional rejection.

V. Conclusion.

Applicant submits all of the claims, as amended, have overcome all of the objections and rejections, for the reasons set forth above.

A timely Notice of Allowance is therefore respectfully solicited.

Applicant requests any underpayment of a necessary fee be charged or any overpayment of a fee be credited to Deposit Account No. 19-4375.

Respectfully submitted,

/anthony p venturino/

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